

WHAT IS CLAIMED IS:

1. A common-mode choke coil comprising:

a first magnetic substrate;

multi-layer coil part in that electrically insulating
5 layers and coil patterns formed alternately on said first
magnetic substrate, the multi-layer coil part having a central
portion surrounded by the coil patterns and an outer removal
portion at where the electrically insulating layers
corresponding to outer circumferential regions of the coil
10 patterns are removed;

a magnetic powder containing region provided on the
uppermost one of the electrically insulating layers and in the
outer removal portion, a surface of the magnetic powder
containing region being flattened; and

15 a second magnetic substrate on the flattened layer of the
magnetic powder containing region through an adhesive.

2. A common-mode choke coil array comprising a
plurality of common-mode choke coils, each comprising:

20 a first magnetic substrate;

multi-layer coil part in that electrically insulating
layers and coil patterns formed alternately on said first
magnetic substrate, the multi-layer coil part having a central
portion surrounded by the coil patterns and an outer removal
25 portion at where the electrically insulating layers

corresponding to outer circumferential regions of the coil patterns are removed;

a magnetic powder containing region provided on the uppermost one of the electrically insulating layers and in the
5 outer removal portion, a surface of the magnetic powder containing region being flattened; and

a second magnetic substrate on the flattened layer of the magnetic powder containing region through an adhesive.

10 3. A method of producing a common-mode choke coil, comprising the steps of:

forming electrically insulating layers and coil patterns alternately on a first magnetic substrate;

removing central regions of said electrically insulating
15 layers surrounded by said coil patterns and portions of said electrically insulating layers corresponding to outer circumferential regions of said coil patterns;

applying a magnetic power-containing resin onto an uppermost one of said electrically insulating layers and
20 embedding said magnetic power-containing resin in removed portions of said electrically insulating layers;

polishing a surface of said magnetic powder-containing resin after curing said magnetic powder-containing resin to flatten said surface; and

25 bonding a second magnetic substrate onto said flattened

surface of said magnetic powder-containing resin by an adhesive agent.

4. A method of producing a common-mode choke coil
5 according to Claim 3, wherein said magnetic powder-containing resin is applied and formed by a printing process.

5. A method of producing a common-mode choke coil
according to Claim 3, wherein said magnetic power-containing
10 resin provided by said coating step has a thickness not smaller than 1.5 times as large as a difference in level of said removed portions of said electrically insulating layers.

6. A method of producing a common-mode choke coil
15 according to Claim 3, wherein said etching step is performed whenever one of said electrically insulating layers is formed.

7. A thin-film type common-mode choke coil
comprising:

20 a laminated structure having a magnetic substrate; and electrically insulating layers and conductor layers laminated on said magnetic substrate in a direction of thickness,

wherein said conductor layers form at least two coil
25 conductors; at least two of said conductor layers are provided

as spiral conductor patterns; and said spiral conductor patterns satisfy the expression:

$$5 \mu\text{m} \leq W1 \leq 36 \mu\text{m}$$

in which W1 is the conductor width of each of said spiral
5 conductor patterns.

8. A thin-film type common-mode choke coil according to Claim 7, wherein said spiral conductor patterns satisfy the expression:

10 $100 \mu\text{m}^2 \leq T * W1$

in which T is the conductor thickness of each of said spiral conductor patterns.

9. A thin-film type common-mode choke coil according
15 to Claim 7, wherein said spiral conductor patterns satisfy the expression:

$$W2 < T \times 2$$

in which W2 is the space between said spiral conductor patterns,
and T is the conductor thickness of each of said spiral conductor
20 patterns.

10. A thin-film type common-mode choke coil according to Claim 7, wherein each of said spiral conductor patterns is composed of an undercoat conductor formed as a thin film, and

a thickened conductor formed on said undercoat conductor and provided as a Cu-plating layer.

11. A thin-film type common-mode choke coil according
5 to Claim 10, wherein said undercoat conductor is made of a combination of a lower layer of Cr and an upper layer of Cu or a combination of a lower layer of Ti and an upper layer of Cu.

12. A thin-film type common-mode choke coil according
10 to Claim 10, wherein a surface of each of said spiral conductor patterns is covered with an Ni-plating film.

13. A thin-film type common-mode choke coil according
to Claim 7, wherein an upper surface of said laminated structure
15 is covered with a magnetic material.

14. A thin-film type common-mode choke coil according
to Claim 7, wherein another magnetic substrate is bonded to an
upper surface of said laminated structure.

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15. A thin-film type common-mode choke coil array
comprising a plurality of thin-film type common-mode choke
coils, each comprising:

a laminated structure having a magnetic substrate; and
25 electrically insulating layers and conductor layers

laminated on said magnetic substrate in a direction of thickness,

wherein said conductor layers form at least two coil conductors; at least two of said conductor layers are provided
5 as spiral conductor patterns; and said spiral conductor patterns satisfy the expression:

$$5 \mu\text{m} \leq W1 \leq 36 \mu\text{m}$$

in which W1 is the conductor width of each of said spiral conductor patterns.